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14. ABSTRACT

A software package for passing Simulated Warfare Environment Generator (SWEG) and Joint Interim Mission Model (JIMM) shared memory data in Link-16 format has been developed. The Air Combat Environment Test and Evaluation Facility (ACETEF) has special consoles (Mini-Crew Stations) which are interfaced to the warfare model with this software. Each station plays the role of an aircraft in the simulation and displays its information to the pilot in Multifunctional Information Distribution System (MIDS) format. The software functionality, initial demonstration results and plans for further upgrades will be discussed in this paper.

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MIDS Simulation at ACETEF

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ABSTRACT: *A software package for passing Simulated Warfare Environment Generator(SWEG) and Joint Interim Mission Model(JIMM) shared memory data in Link-16 format has been developed. The Air Combat Environment Test and Evaluation Facility(ACETEF) has special consoles(Mini-Crew stations) which are interfaced to the warfare model with this software. Each station plays the role of an aircraft in the simulation and displays its information to the pilot in Multifunctional Information Distribution System (MIDS) format. The software functionality, initial demonstration results and plans for further upgrades will be discussed in this paper.*

1. Overview

A MIDS simulation capability is being developed at ACETEF which links to the simulated warfare environment generated by the SWEG/JIMM[1] models. The MIDS graphical user interface display software runs on mini-crew stations. Multiple aircraft may be simulated simultaneously within a gaming environment using these manned stations.

The proposed system consists of the following parts:

1) A mini-crew station with a touch panel display, a hand controller,a throttle and graphics support software to emulate the principal functions of a MIDS display.
2) An interface between the MIDS display program and the SWEG/JIMM model. This model serves as the MIDS mission control computer(MC).
3) A JIMM/SWEG process run using reflected shared memory[2].
4) A Multi-Link System Test/Training Tool(MLST3)[3] JIMM interface asset which will stimulate a Combat Direction System interface to produce Link-16 messages for use with aircraft and stimulator hardware.

Table 1 lists a subset of the Link-16 messages that are considered relevant to an F/A-18[4]. These may be modeled in JIMM and processed to the interface or result from interface mission control processing of JIMM shared memory data.

Table 1: F/A-18 Link-16 Messages

Link-16 Message	Label
Air PPLI	J2.2
Surface (Maritime) PPLI	J2.3
Land (Ground) Point PPLI	J2.5
Land(Ground) Track PPLI	J2.6
Reference	J3.0
Air Track	J3.2
Surface (Maritime) Track	J3.3
Land (Ground) Point/Track	J3.5
Electronic Warfare Product Data	J3.7
Track Management	J7.0
Engagement Status	J10.2
Mission Assignment	J12.0
Vector	J12.1
Controlling Unit Change	J12.4
Target/Track Correlation	J12.5
Target Sorting	J12.6

Some applicable messages have been omitted from this table since they pertain to the details of Link-16 electronic signal transmission and networking and are inappropriate for a virtual wargaming environment. Non F/A-18 aircraft will utilize a message set similar to table 1 as well.

2. MIDS Simulation Software

The MIDS simulation software is described in the next two sections. The MIDS multi-tiered menuing system, situational awareness displays and an interface to the SWEG/JIMM engine are all part of this package.

2.1 Graphical User Interface

The baseline MIDS display is shown in figure 1 and consists of a Multipurpose Display Indicator(MDI), a Multipurpose Color Display Indicator(MPCD) and an Up-Front Control (UFC). Gauges are displayed for throttle/fuel, heading, attitude,altitude, speed and climb/dive rate as well.

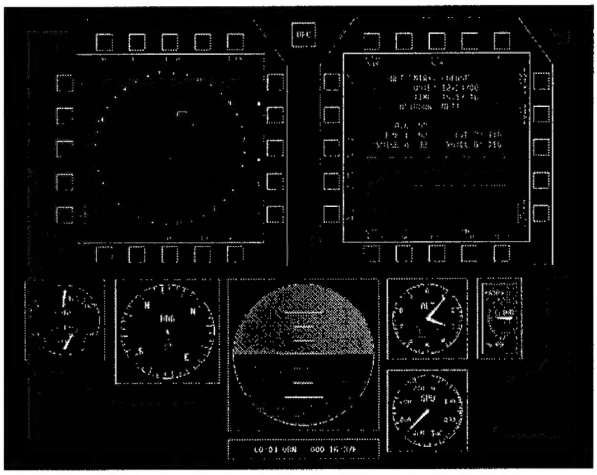

Figure 1: MIDS Simulation Display

The MDI and MPCD screens are surrounded by twenty push buttons. These buttons allow the pilot to navigate up and down through the menu levels. The top-level MIDS Support display has a menu push button which leads to the MIDS Terminal Control Format menu which shows network status information. The top-level Tactical menu has both a Situational Awareness(SA) menu and an Attack menu beneath it.

The SA menu contains precise participant location and identification (PPLI) and surveillance tracks displayed in appropriate MIDS symbology in a compass display format. The Attack menu contains Link-16 along with sensor information in a radar display format. The SWEG/JIMM model performs the Multi-Source Integration(MSI) function and creates a "perception list" from which the Attack display is filled.

2.2 SWEG/JIMM Model and Interface

The JIMM and SWEG models have a common origin and are both language-based. These models permit the developer to create objects that have capabilities, susceptibilities, resources, tactics and systems(i.e. sensors, weapons, communicators, jammers, thinkers and movers). Player, platform and system object information is stored in persistent shared memory. Interactions between objects and events involving objects appear in the form of "asset action messages". Each hardware and software asset to the SWEG/JIMM model has a block of shared memory(i.e. a "mailbox") allocated for such messages. The MLST3 interface and each MIDS simulation will be an asset. It should be possible to run more than ten MIDS simulation assets simultaneously in real-time. Each MIDS simulation asset will assume the role, mission and function of one aircraft in the environment. This feature will allow SWEG/JIMM players, MIDS simulation players and real aircraft connected via MLST3 to all interact in the same environment.

The MIDS display interface receives PPLI information from designated platforms via persistent shared memory. Link-16 explicit communication messages are read from the asset's shared memory mailbox. The perception list comes into the interface through the mailbox as well. The Link-16 messages are generated dynamically by the model and sent to the appropriate C4ISR assets.

The SWEG/JIMM model handles the content of the J7.0(Track Management) and J12.5(Target/Track Correlation) messages internally. Since the model is performing this part of the mission computer function for all assets, these messages need not be broadcast.

3. Operational Testing

The prototype MIDS display, graphical user interface and MIDS SWEG/JIMM scenario databases have been run successfully. Virtual tracks in the scenario appear on the display in the appropriate locations and the response of the virtual MIDS aircraft to pilot actions is good. The data reflected on the gauges match well with the content of persistent shared memory. As more capability is added to the scenario and simulation, matching requirements will be written and results will be documented.

3.1 SWEG/JIMM Scenario

The prototype MIDS scenario passes PPLI and surveillance information via explicit communications messages. Explicit communications messages may be sent to or received from an asset's interface. Each Network Participation Group(NPG) in the game is represented as a separate communications network. Donors and member are thus, organized at the scenario database level- not in the interface.

An E-2C and an F/A-18 aircraft constitute the MIDS C2 participants in the scenario. There are generic targets for air, ground, surface and ELINT in the scenario as well. These players are sufficient to test existing capabilities.

4. Future Plans

The important features which need to be built into the ACETEF MIDS simulation pertain to command and control. There are some less-critical features like cursor slewing and on-screen data availability which will be added nonetheless. The level of detail will be driven by customer demand.

The J10.2(Engagement Status), the J12.0(Mission Assignment) and J12.1(Vector) messages will be added. Changes to the SWEG/JIMM model are required to execute these messages properly. At the moment, the recipient will calculate a flight path given a target rather than following the command heading, speed and altitude in J12 series messages.

5. Summary

A software package has been written which emulates a MIDS display on a Mini-Crew station and interfaces to the SWEG/JIMM model . The prototype version has considerable tested capability and greater functionality is to be added in the coming year.

6. References

[1] TRW, Incorporated: "JIMM1.2 USERS GUIDE" September 1999.

[2] Systran Corporation: "SCRAMNet®-LX Network EISA Hardware Interface Reference" Document No. C-T-MR-EISALX##-A-0-A1 February 1995.

[3] Logicon, Incorporated: "System Specification for the MULTOTS/ISA Multi-Link System(MLS) for Naval Air Test Center CNIL" LGN 109-1100130-04 June 1991.

[4] Boeing Corporation: "MIDS Student Guide" F1839OSE00-00121-0 Revised 25 April 2000.

Author Biographies

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JOHN MCMASTER is the leader of the Interface Development Team at ACETEF. John has developed software for the ACETEF HLA interface and the DISI interface. John has participated in Atlantic Ranges and Facilities projects such as JSF VSWE events, ACETEF-REDCAP integration, JADS-EW, HLA Engineering Protofederation(1996), STOWE-1994 and KERNEL BLITZ. John received his BSEE from Drexel University in 1982 and is a member of IEEE and NMIA.

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MICHAEL WILLMORE is the Corporate Chief Scientist at American Electronic Warfare Associates, Incorporated. He is also the lead scenario developer in the ACETEF Modeling and Simulation group. During his twenty-one years of service in the United States Navy, he received numerous awards and citations for his achievements as a naval aviator and for research projects done as a staff officer at the Naval War College's Center for Advanced Research. Lieutenant Commander Willmore authored a book entitled "Principles of Engagement Analysis" and contributed to "The Art of Wargaming" authored by Dr. Peter Perla. Michael has held many high level positions within the defense industry and was nominated for staff positions in the Bush Administration and the Senate Armed Services Committee.